FIG.1

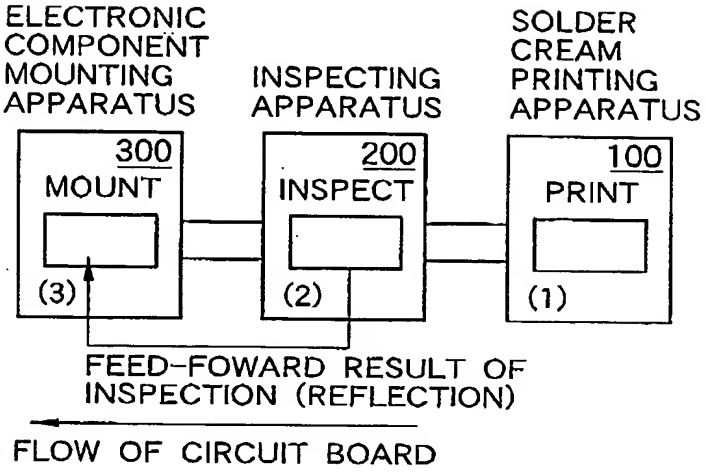

ELECTRONIC COMPONENT MOUNTING APPARATUS
INSPECTING APPARATUS
SOLDER CREAM PRINTING APPARATUS
300
MOUNT
200
INSPECT
100
PRINT
(3)
(2)
(1)
FEED-FOWARD RESULT OF INSPECTION (REFLECTION)
FLOW OF CIRCUIT BOARD

FIG.2

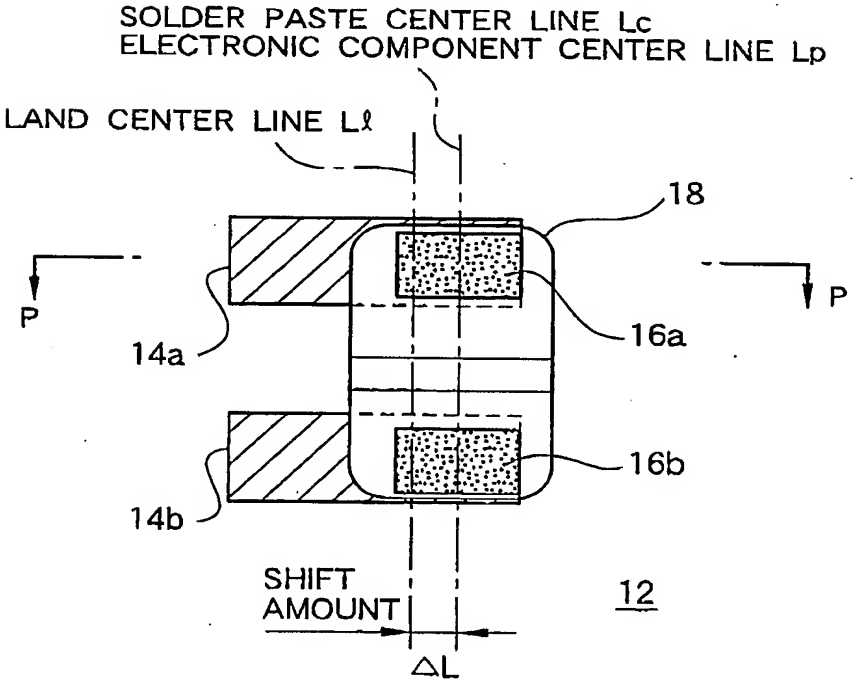

SOLDER PASTE CENTER LINE Lc
ELECTRONIC COMPONENT CENTER LINE Lp
LAND CENTER LINE Lℓ
18
P
P
14a
16a
16b
14b
SHIFT AMOUNT
12
ΔL

FIG.3(a)

FIG.3(b)

FIG.3(c)

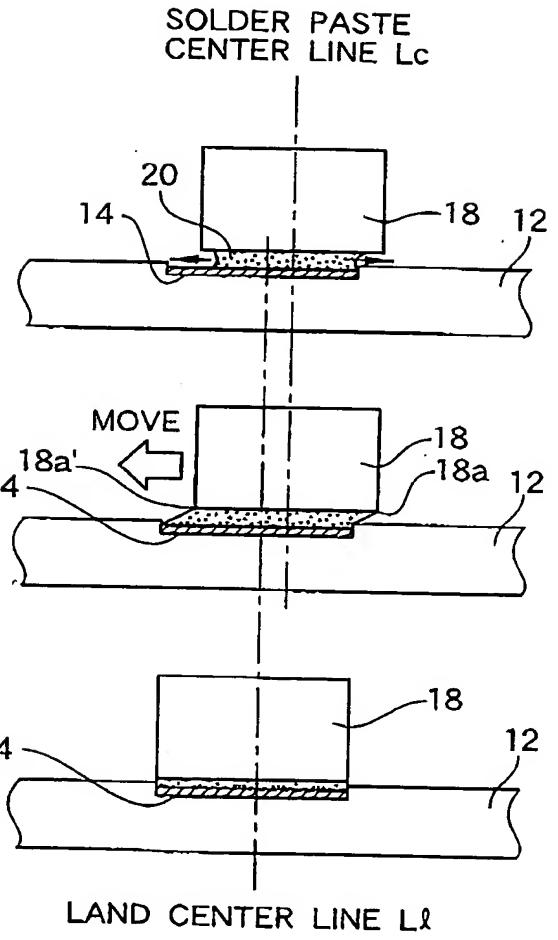


FIG.4(a)

FIG.4(b)

FIG.4(c)

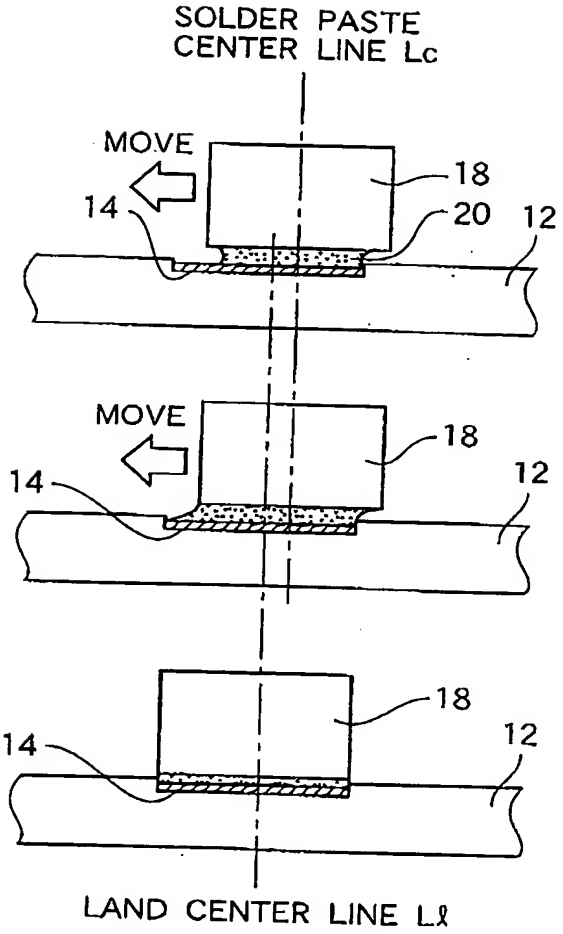


FIG.5

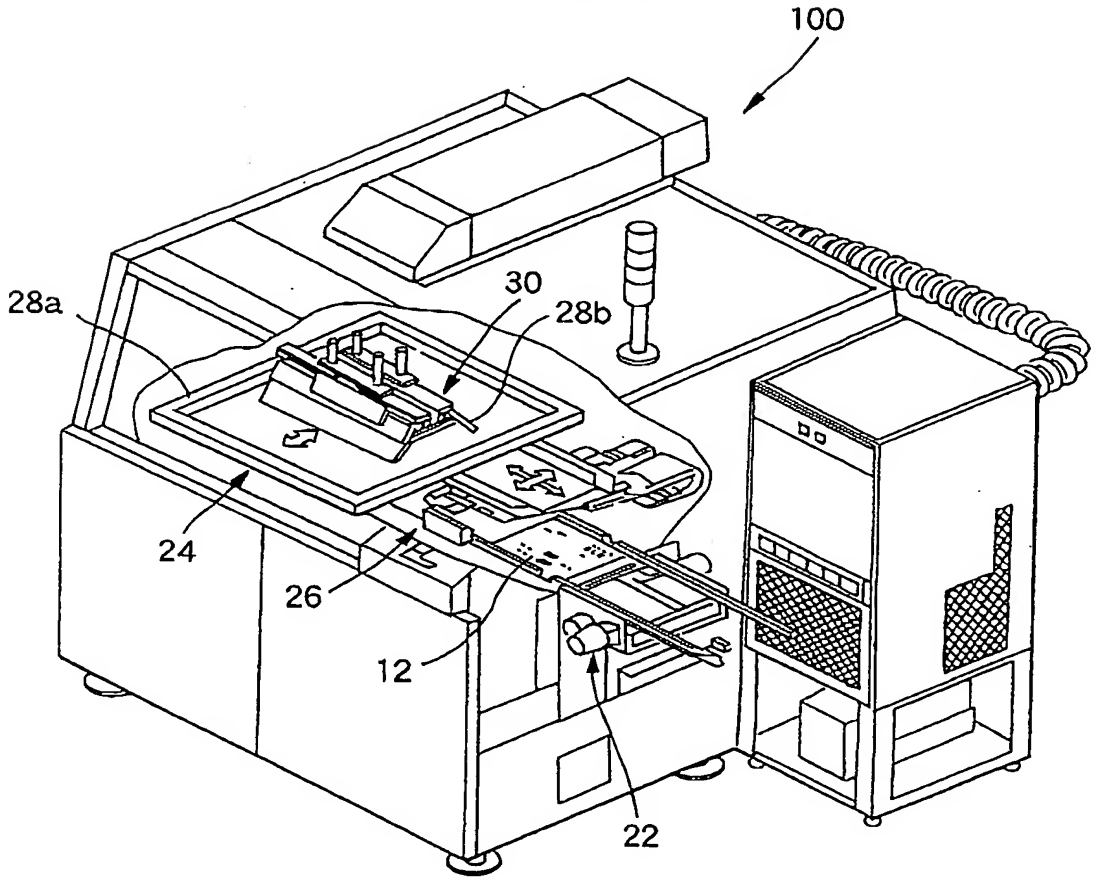


FIG.6

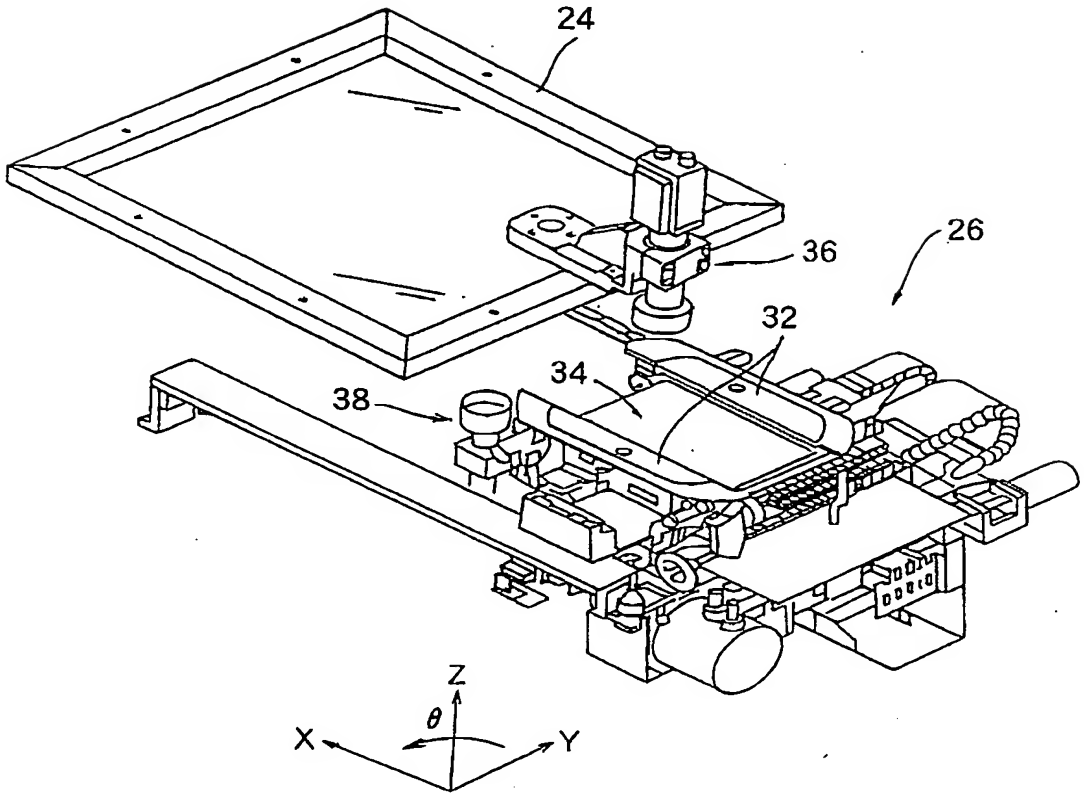


FIG.7

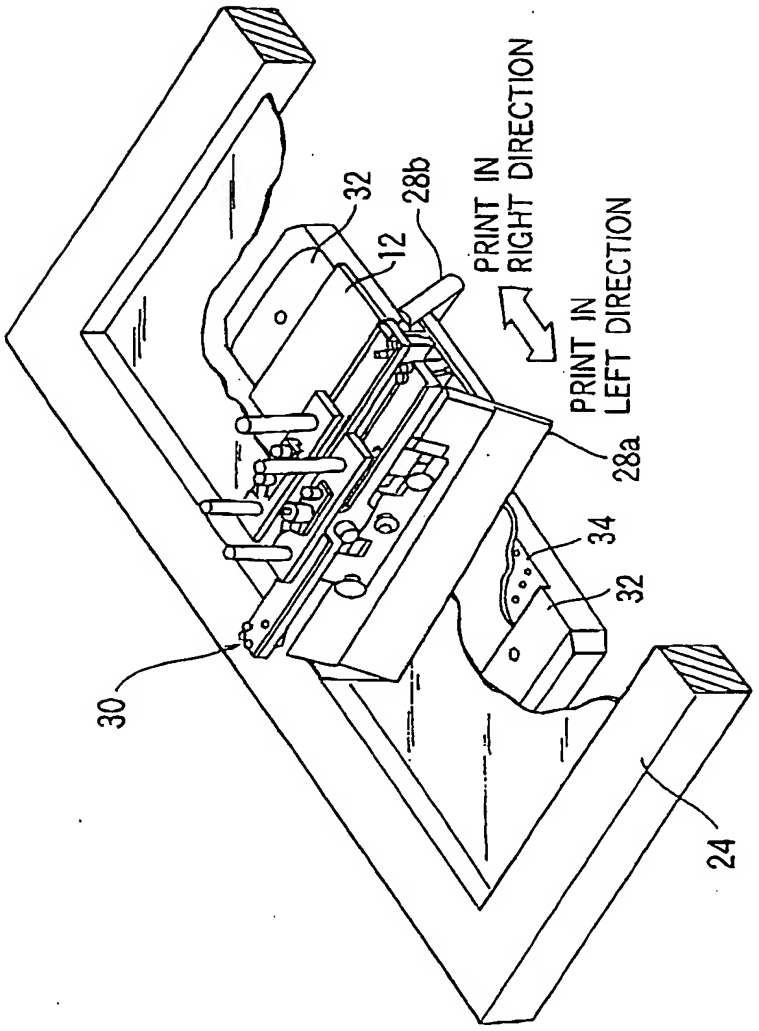

32
28b
12
PRINT IN
RIGHT DIRECTION
PRINT IN
LEFT DIRECTION
28a
34
32
30
24

FIG.8

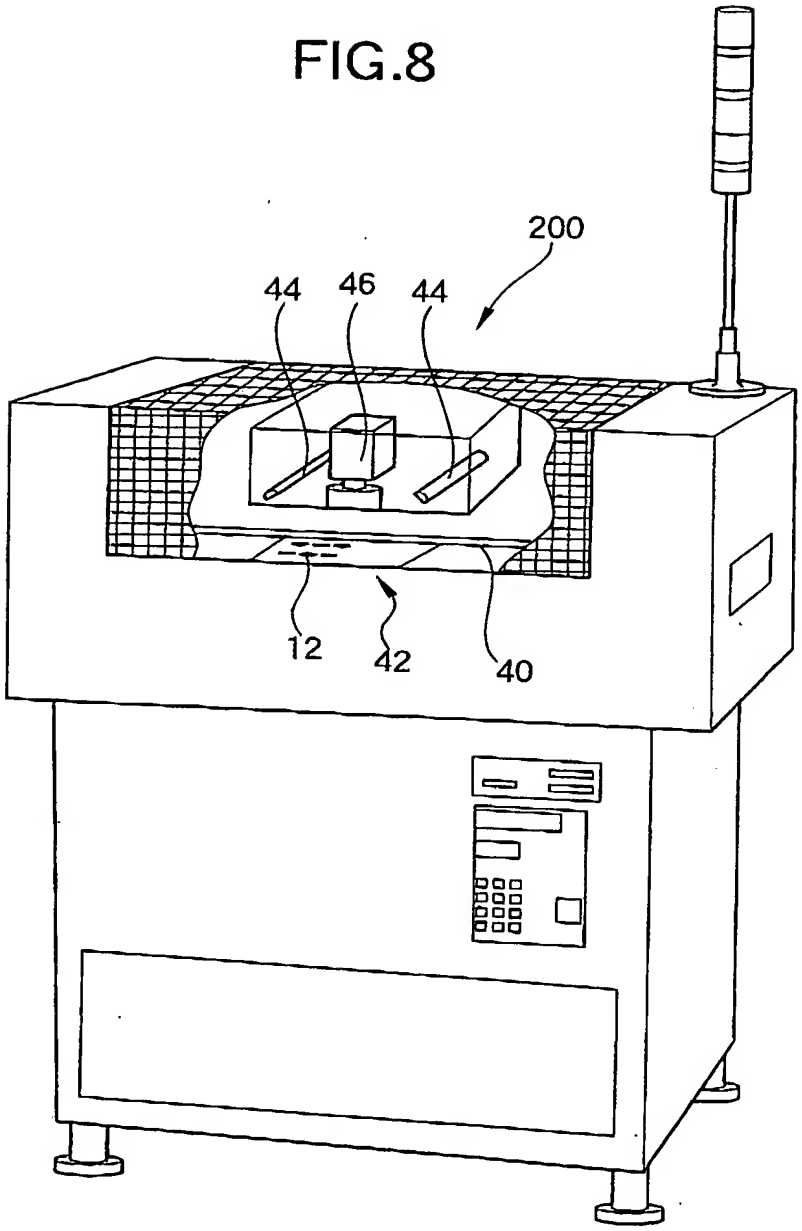


FIG.9

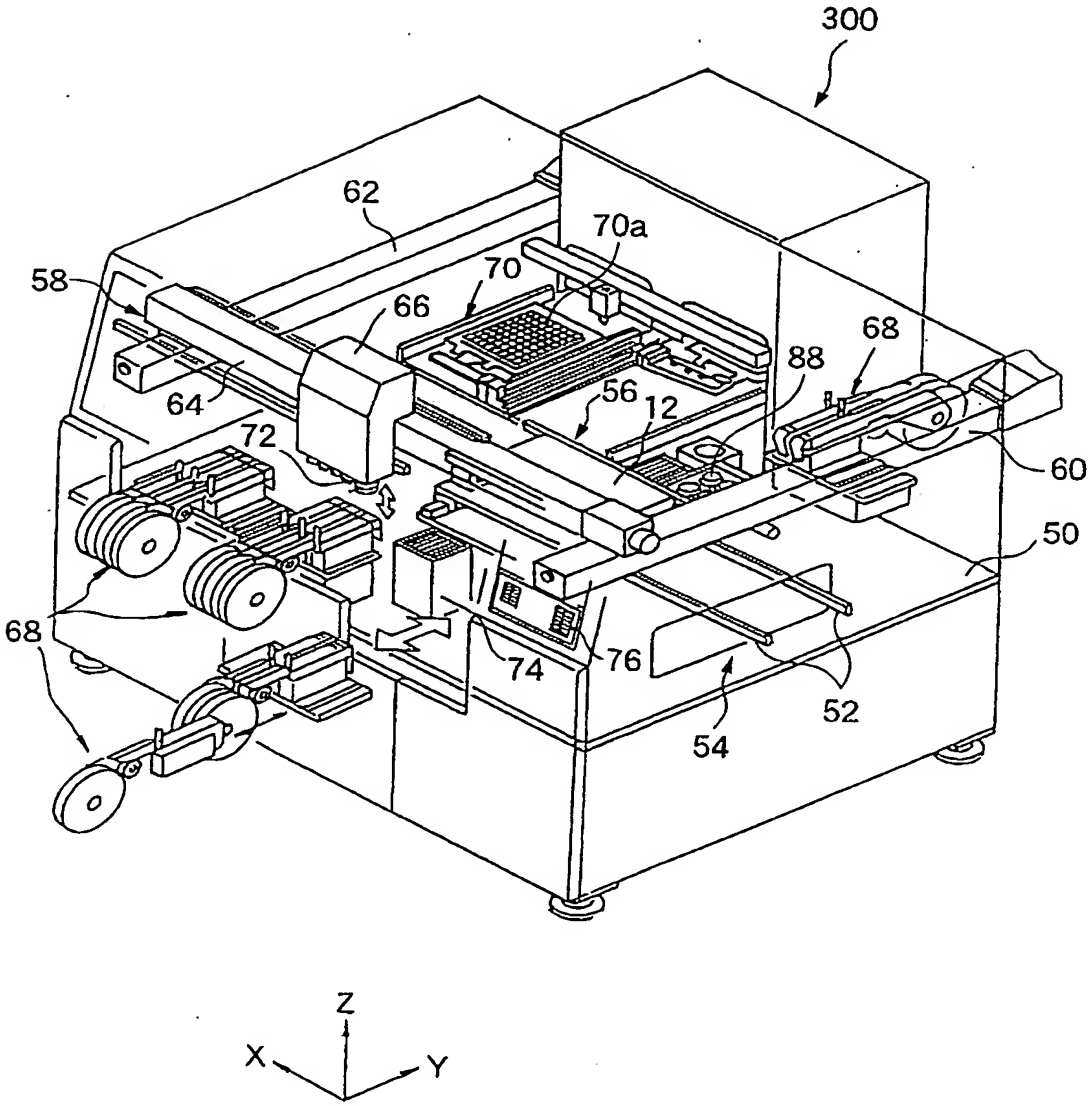


FIG.10

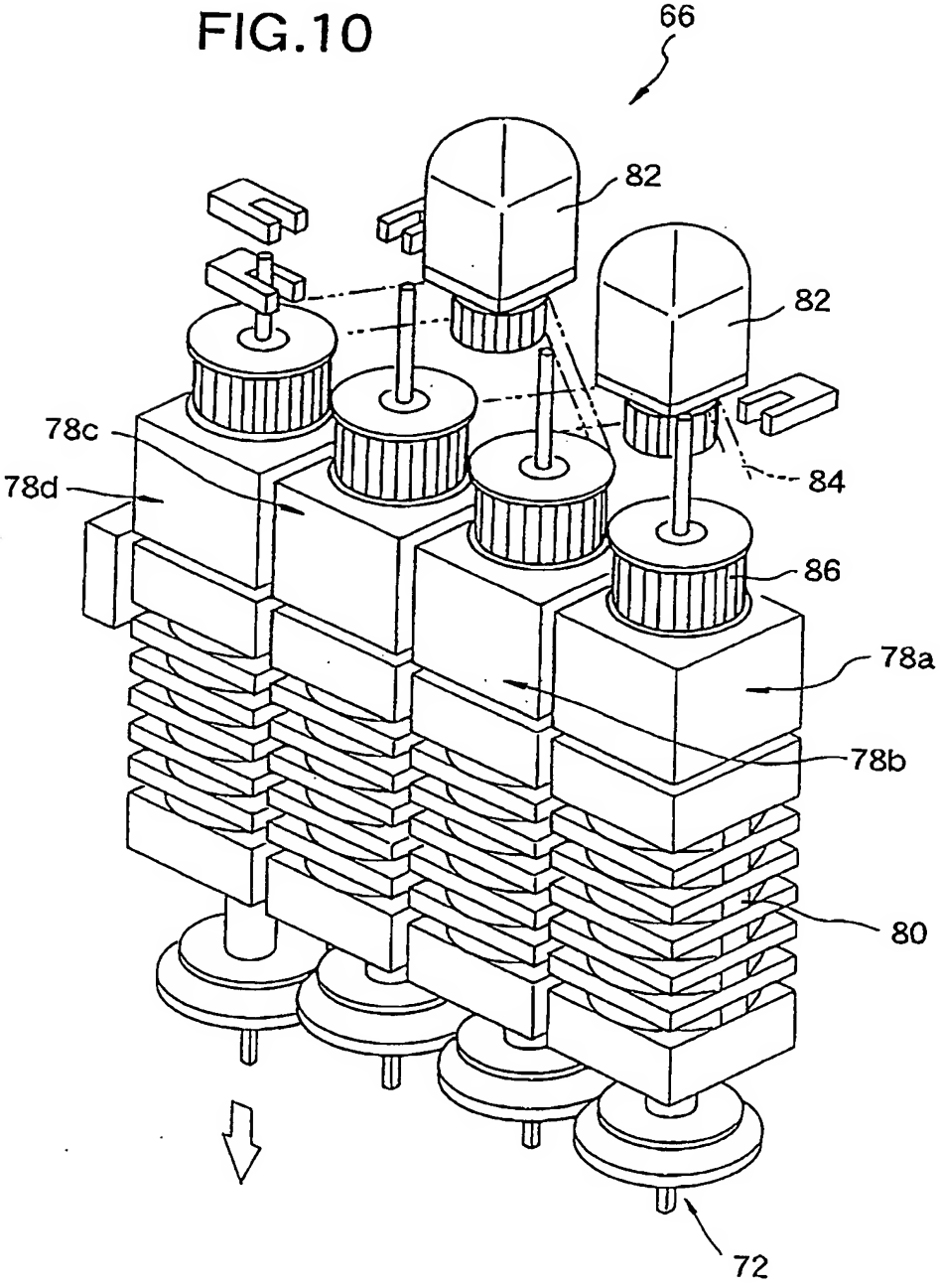


FIG.11

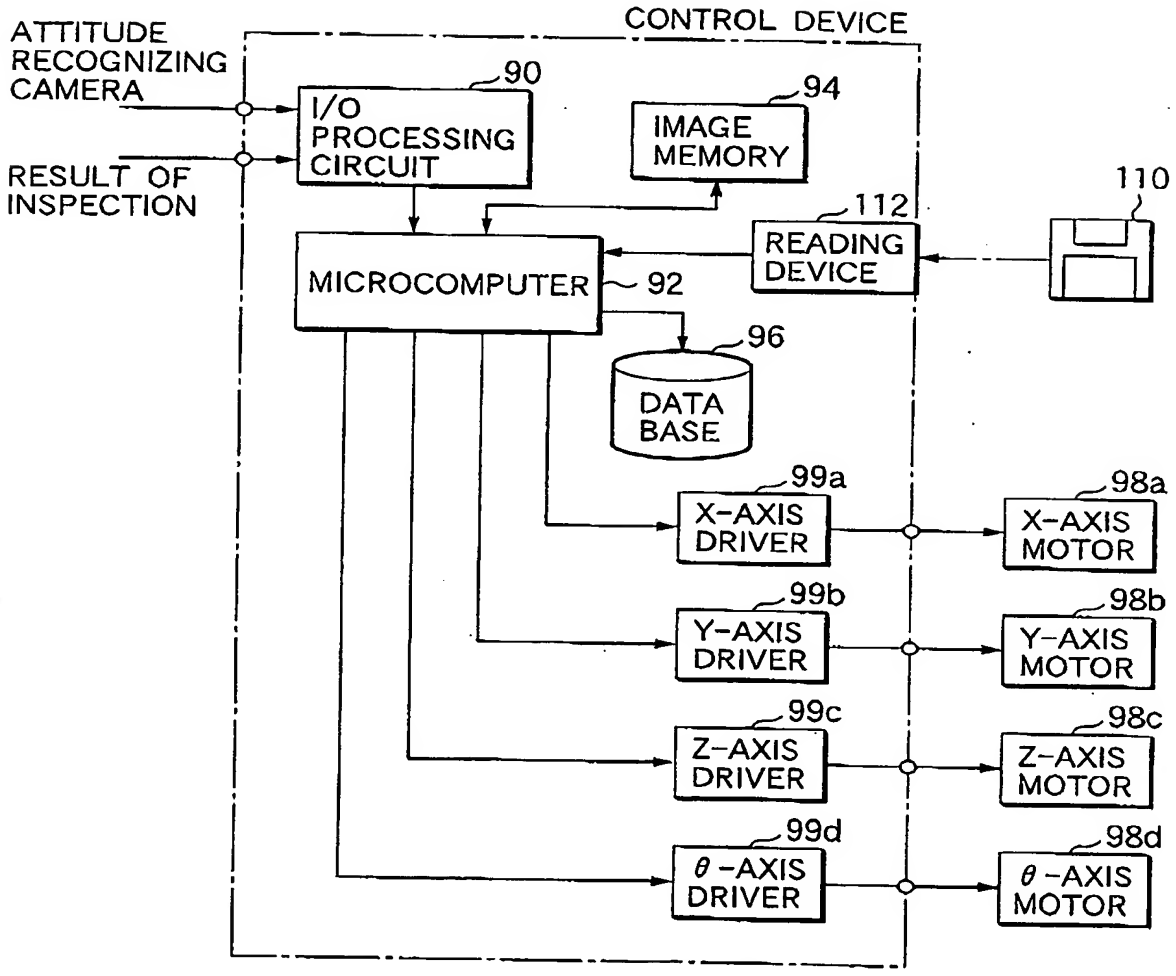

CONTROL DEVICE
ATTITUDE RECOGNIZING CAMERA
RESULT OF INSPECTION
90
I/O PROCESSING CIRCUIT
94
IMAGE MEMORY
110
112
READING DEVICE
MICROCOMPUTER
92
96
DATA BASE
99a
X-AXIS DRIVER
98a
X-AXIS MOTOR
99b
Y-AXIS DRIVER
98b
Y-AXIS MOTOR
99c
Z-AXIS DRIVER
98c
Z-AXIS MOTOR
99d
θ-AXIS DRIVER
98d
θ-AXIS MOTOR

FIG.12

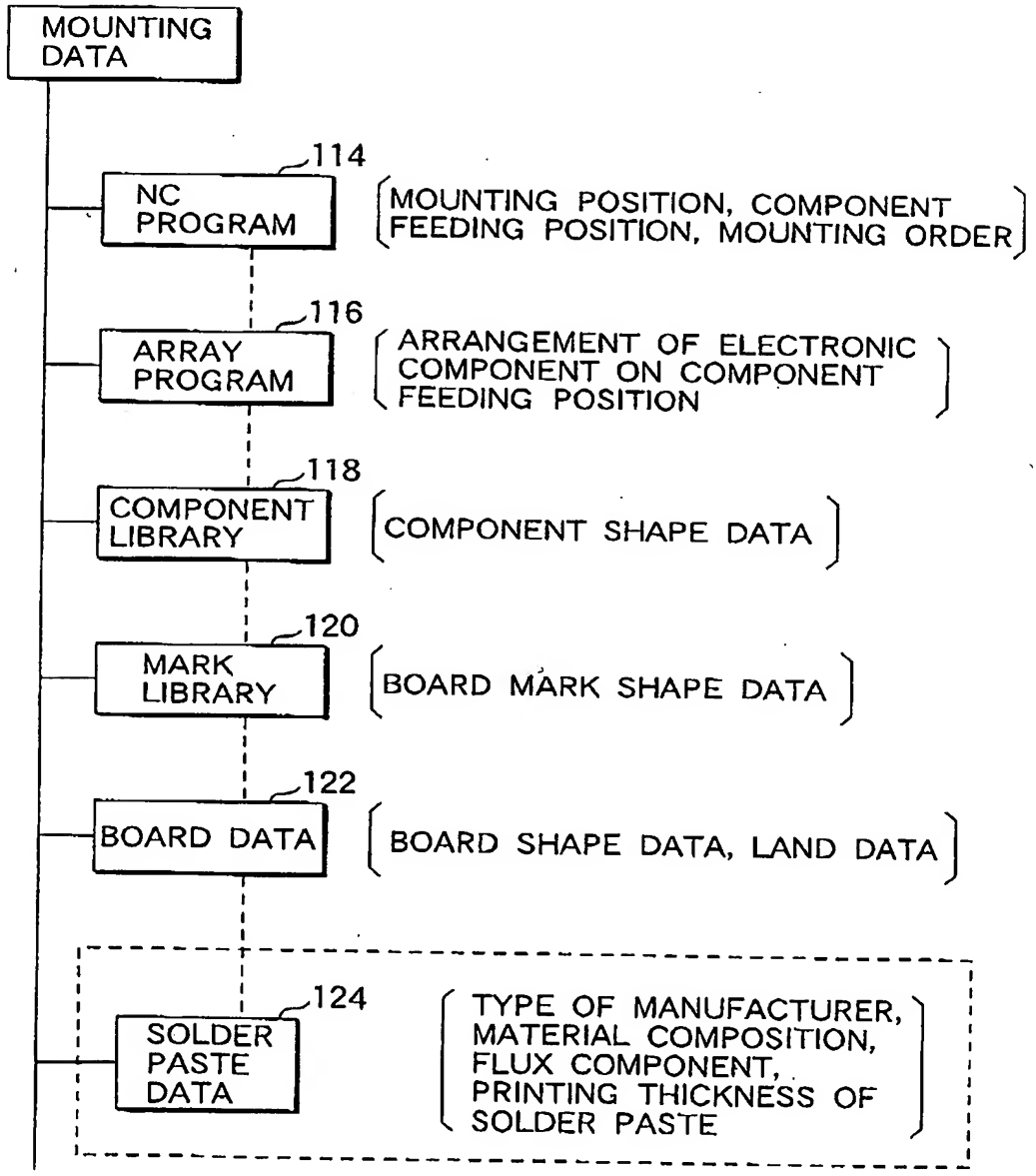

MOUNTING DATA
114
NC PROGRAM
MOUNTING POSITION, COMPONENT FEEDING POSITION, MOUNTING ORDER
116
ARRAY PROGRAM
ARRANGEMENT OF ELECTRONIC COMPONENT ON COMPONENT FEEDING POSITION
118
COMPONENT LIBRARY
COMPONENT SHAPE DATA
120
MARK LIBRARY
BOARD MARK SHAPE DATA
122
BOARD DATA
BOARD SHAPE DATA, LAND DATA
124
SOLDER PASTE DATA
TYPE OF MANUFACTURER, MATERIAL COMPOSITION, FLUX COMPONENT, PRINTING THICKNESS OF SOLDER PASTE

FIG.13

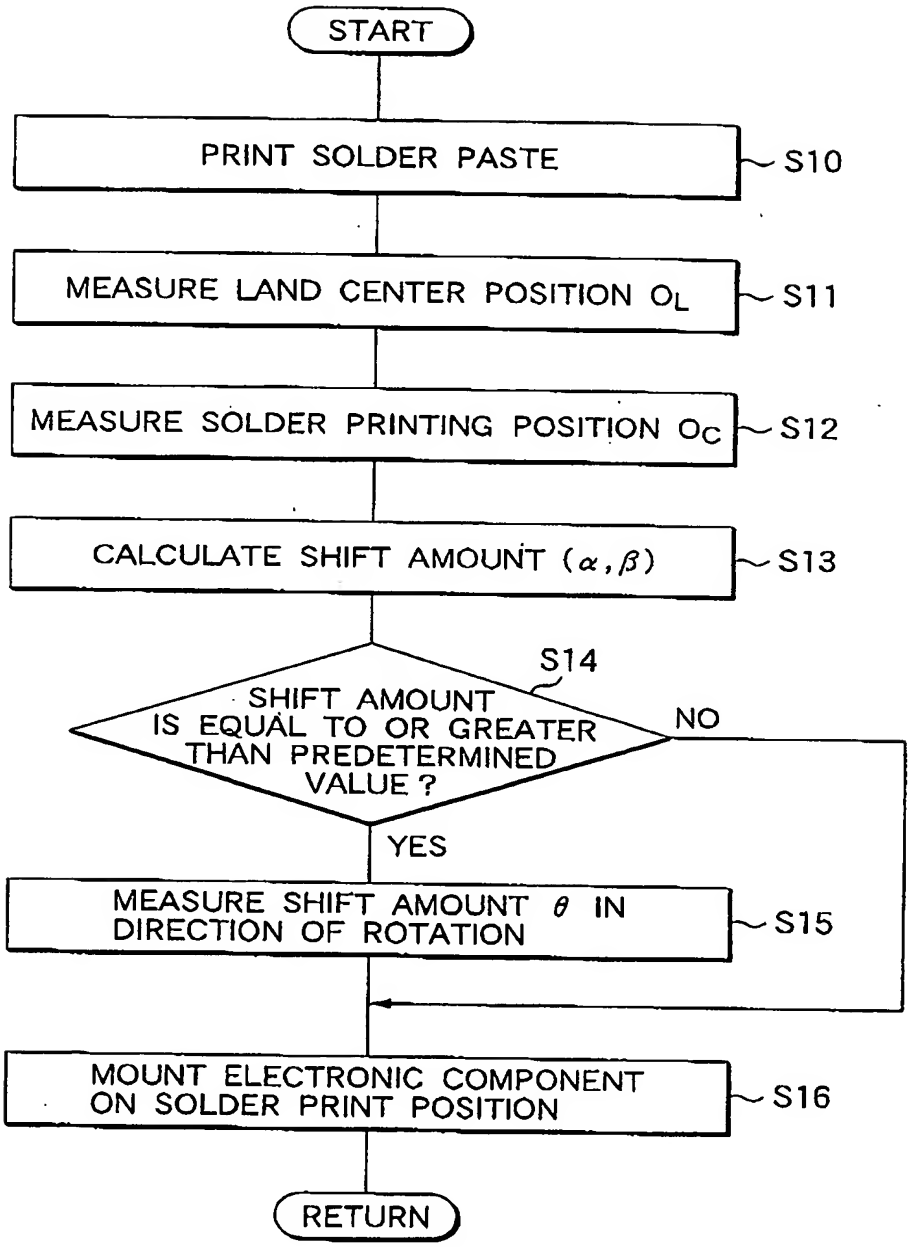

START
PRINT SOLDER PASTE
S10
MEASURE LAND CENTER POSITION O_L
S11
MEASURE SOLDER PRINTING POSITION O_C
S12
CALCULATE SHIFT AMOUNT (α, β)
S13
S14
SHIFT AMOUNT IS EQUAL TO OR GREATER THAN PREDETERMINED VALUE ?
NO
YES
MEASURE SHIFT AMOUNT θ IN DIRECTION OF ROTATION
S15
MOUNT ELECTRONIC COMPONENT ON SOLDER PRINT POSITION
S16
RETURN

FIG.14

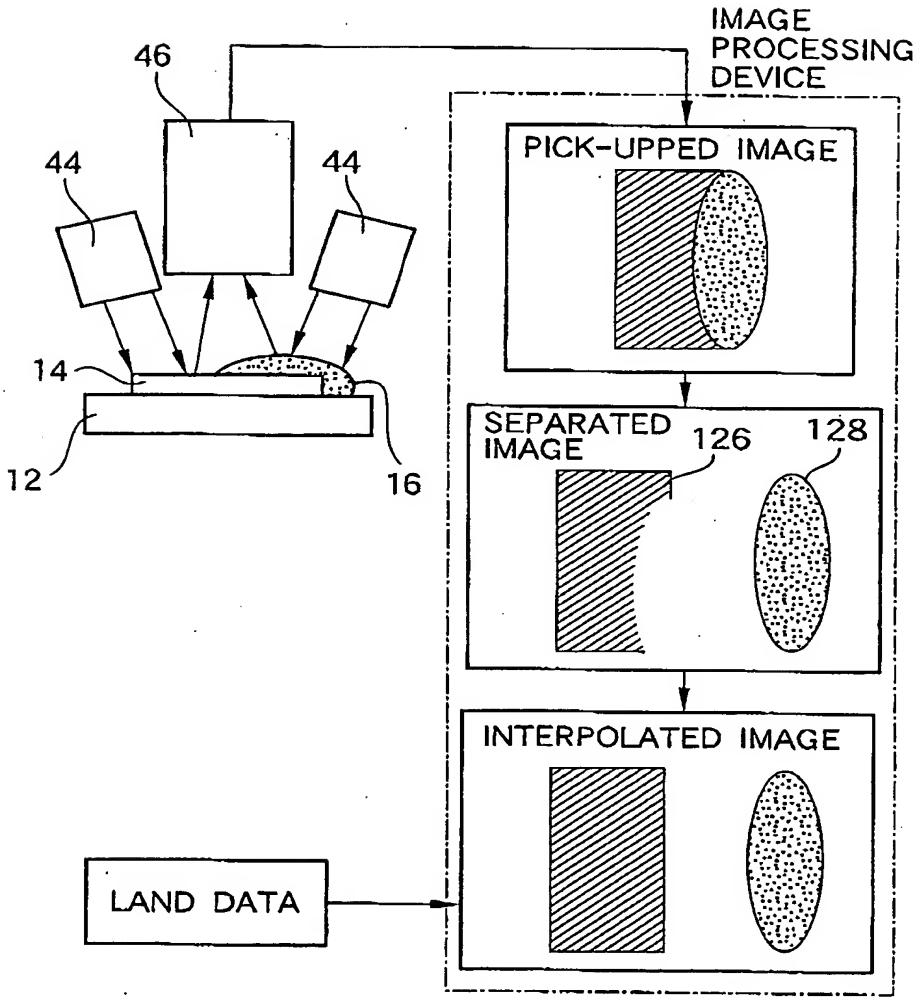


IMAGE PROCESSING DEVICE
46
44
44
14
12
16
PICK-UPPED IMAGE
SEPARATED IMAGE
126
128
INTERPOLATED IMAGE
LAND DATA

FIG.15

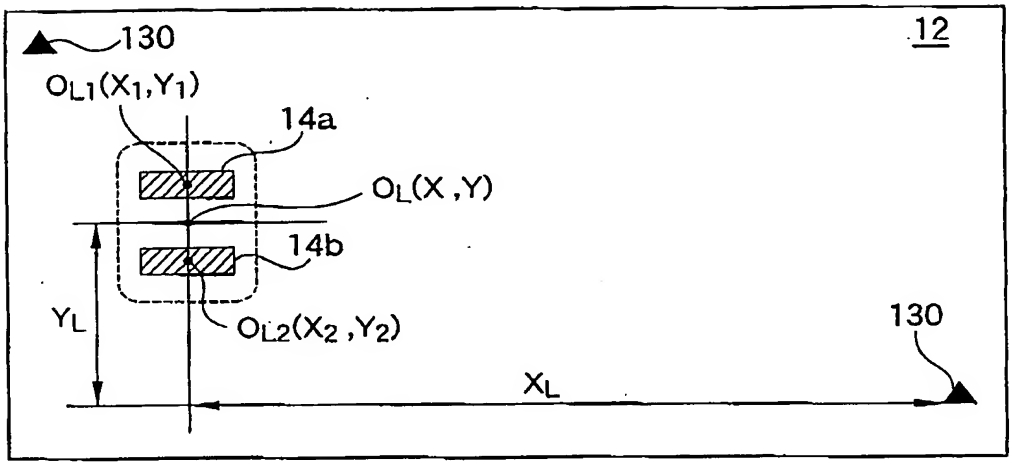

130
12
$O_{L1}(X_1,Y_1)$
14a
$O_L(X,Y)$
14b
Y_L
$O_{L2}(X_2,Y_2)$
130
X_L

FIG.16

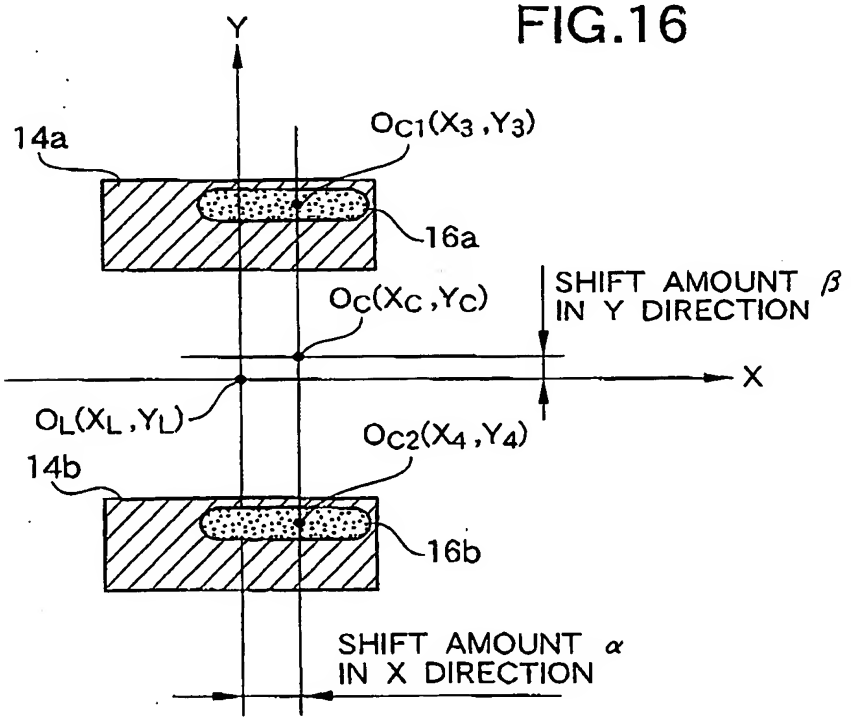

Y
14a
$O_{C1}(X_3,Y_3)$
16a
SHIFT AMOUNT β
IN Y DIRECTION
$O_C(X_C,Y_C)$
X
$O_L(X_L,Y_L)$
$O_{C2}(X_4,Y_4)$
14b
16b
SHIFT AMOUNT α
IN X DIRECTION

FIG.17

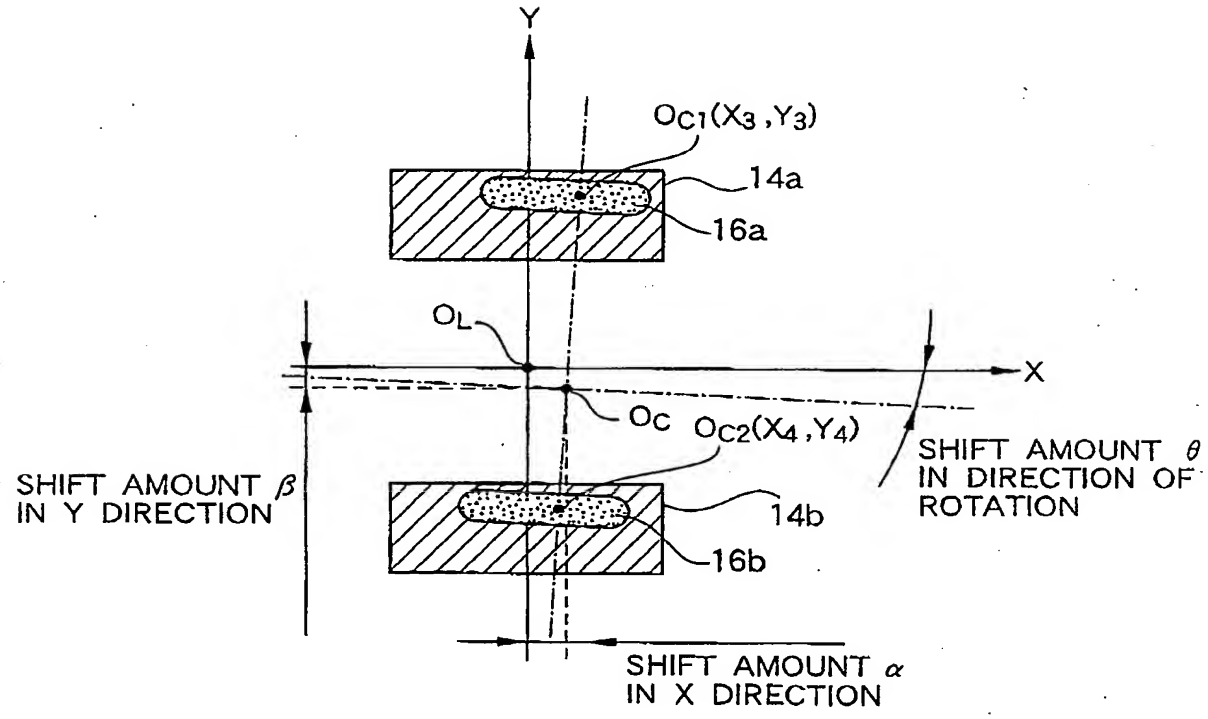

Y
$O_{C1}(X_3, Y_3)$
14a
16a
O_L
X
O_C
$O_{C2}(X_4, Y_4)$
SHIFT AMOUNT θ IN DIRECTION OF ROTATION
SHIFT AMOUNT β IN Y DIRECTION
14b
16b
SHIFT AMOUNT α IN X DIRECTION

FIG.18(a)

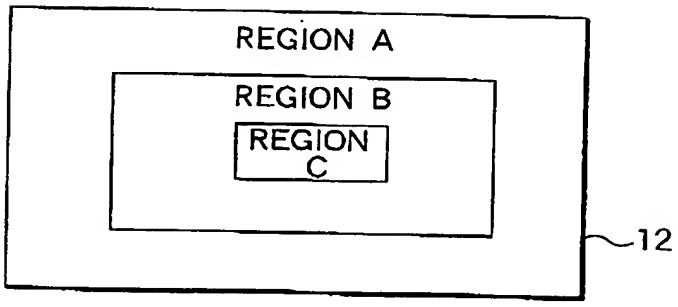


FIG.18(b)

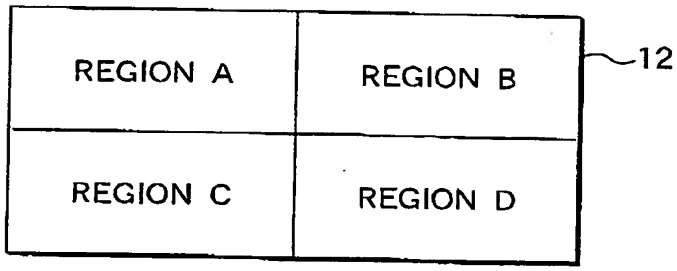


FIG.19

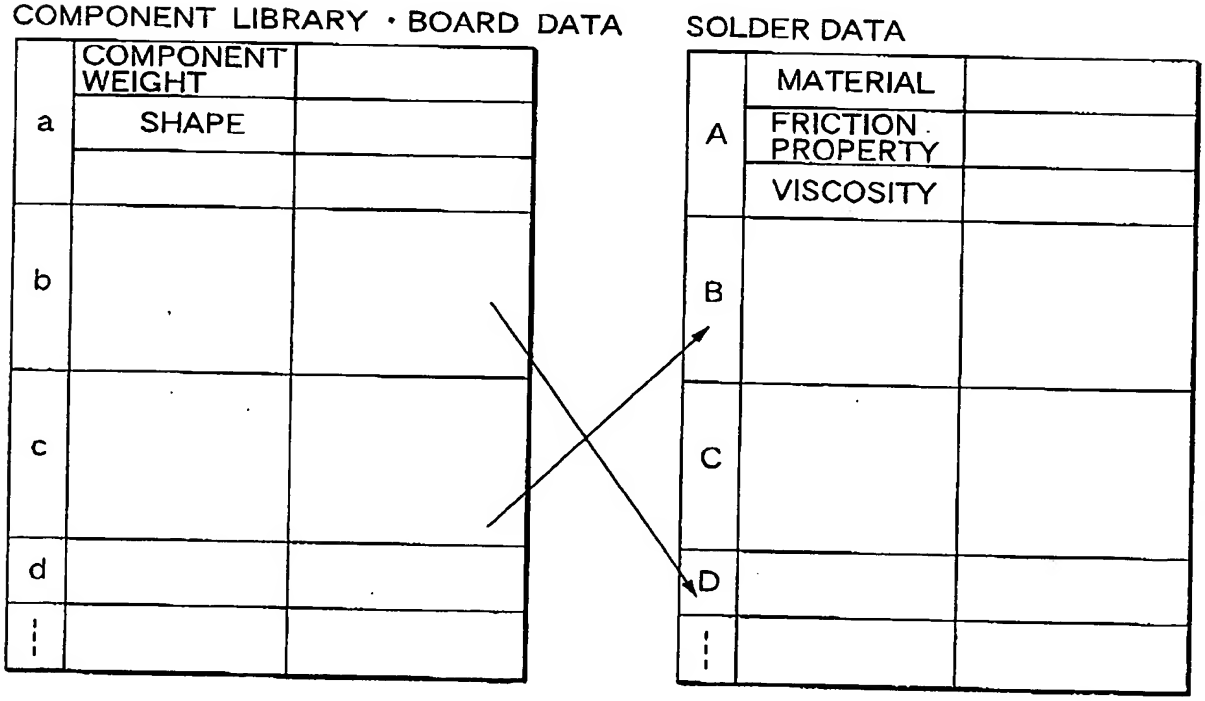


FIG.20(a)

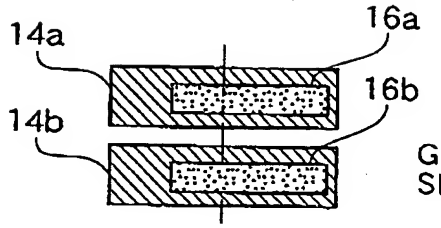


FIG.20(b)

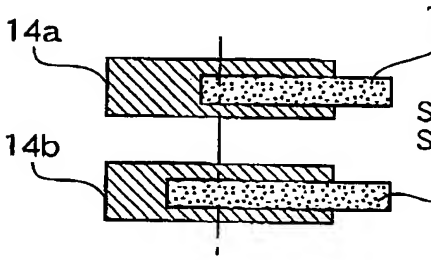


FIG.21

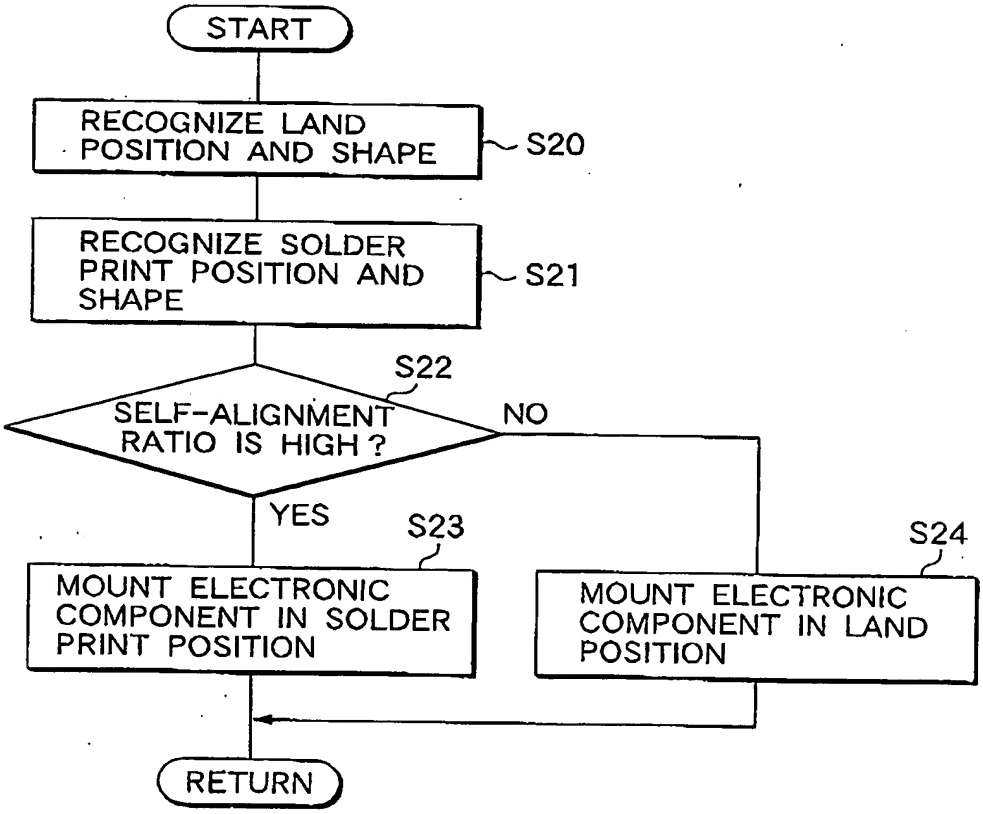


FIG.22

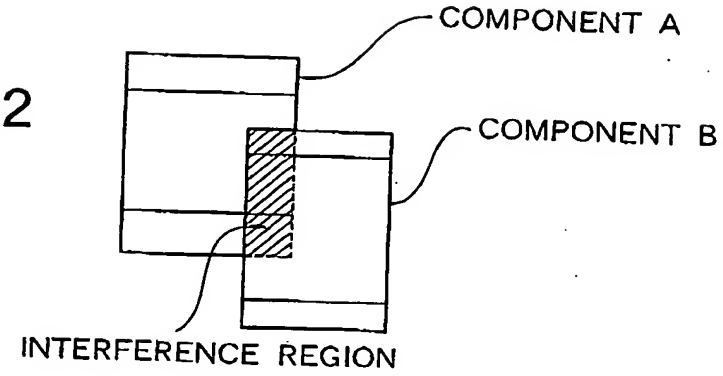


FIG.23

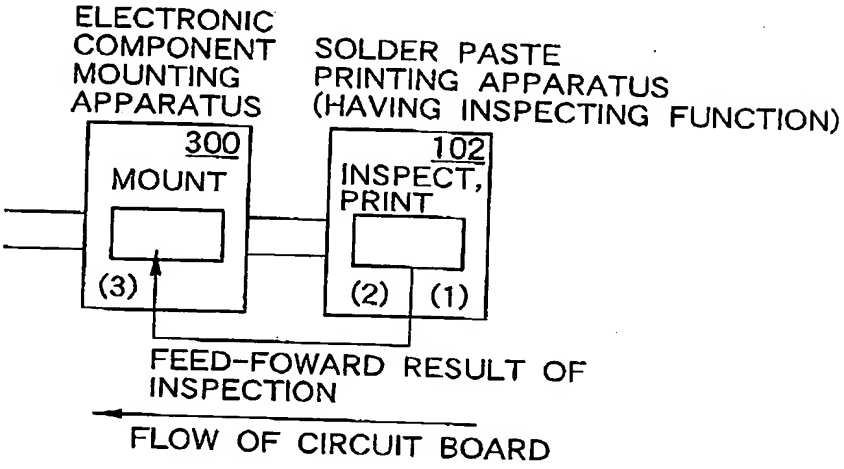


FIG.24

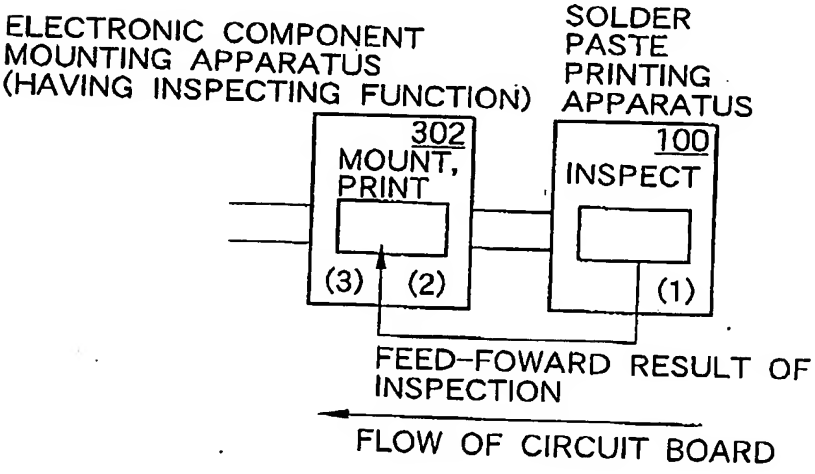
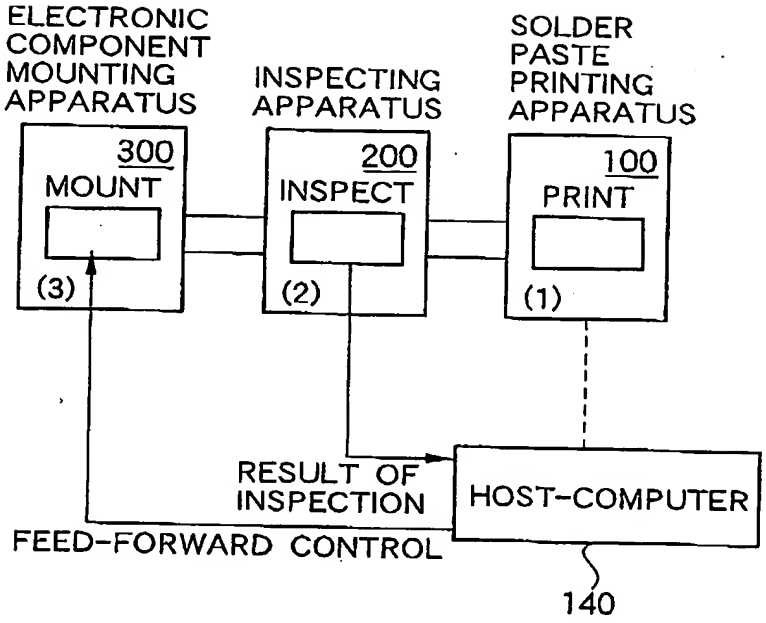


FIG.25


ELECTRONIC COMPONENT MOUNTING APPARATUS
300
MOUNT
(3)
INSPECTING APPARATUS
200
INSPECT
(2)
SOLDER PASTE PRINTING APPARATUS
100
PRINT
(1)
RESULT OF INSPECTION
HOST-COMPUTER
FEED-FORWARD CONTROL
140

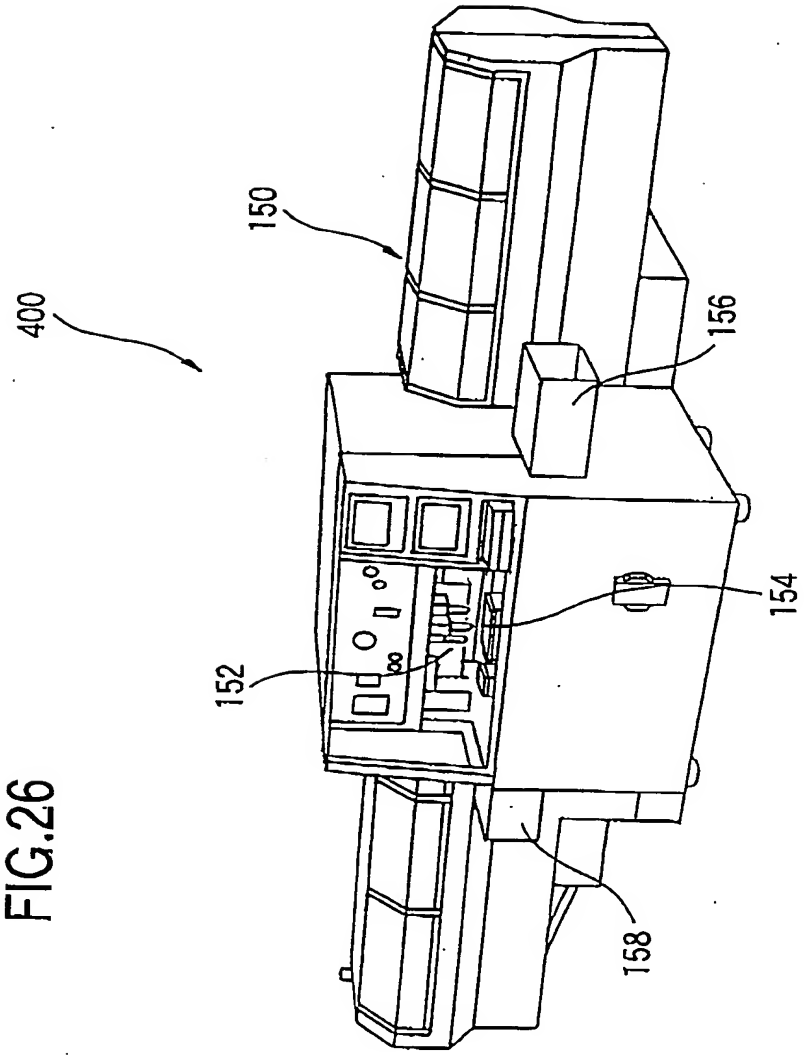


FIG.26

FIG.27

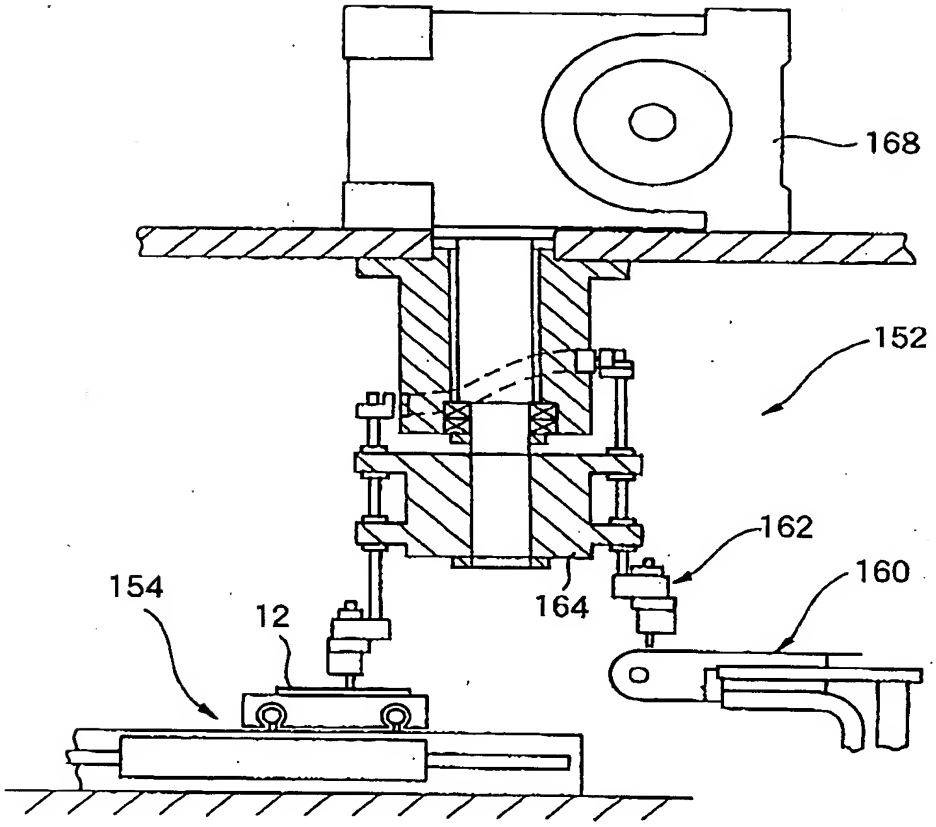


FIG.28(a)

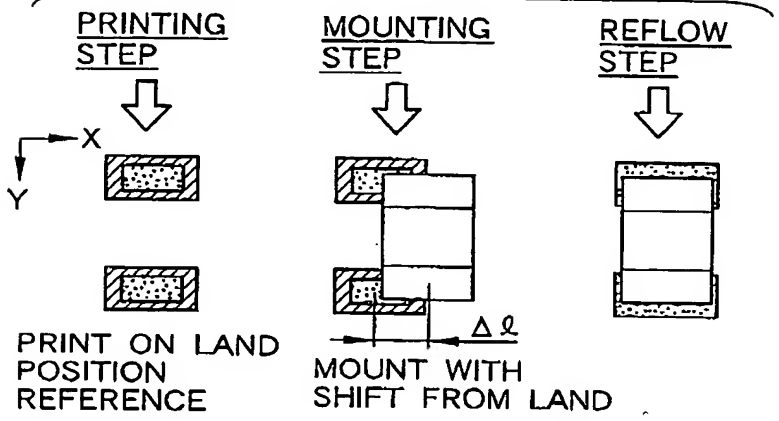


FIG.28(b)

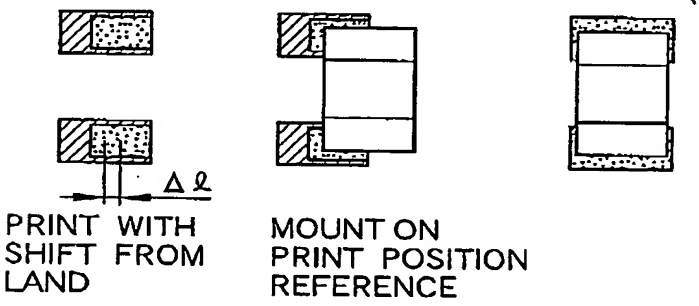


FIG.28(c)

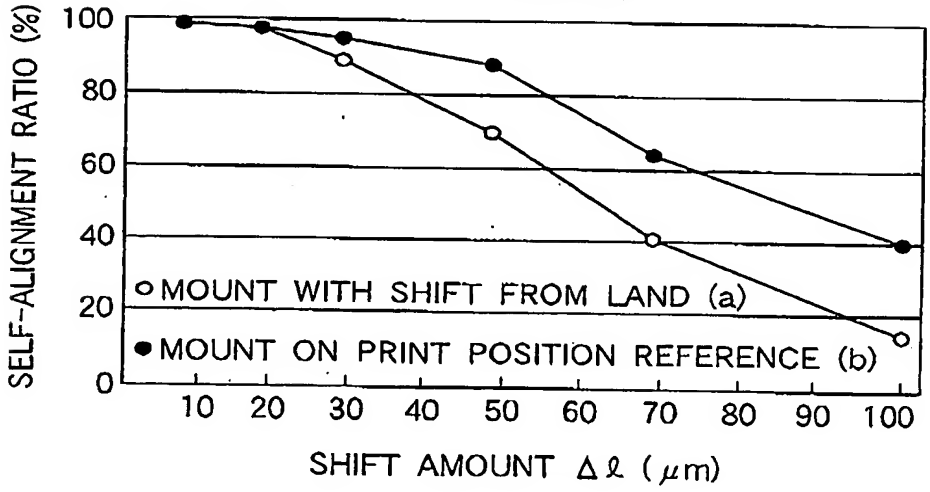


FIG.29

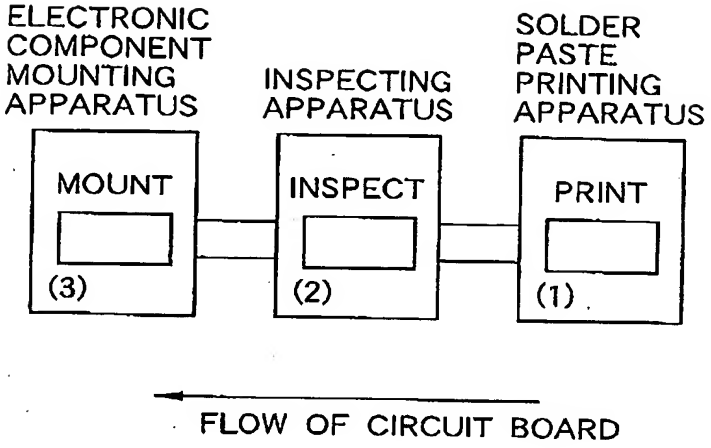


FIG.30(a)

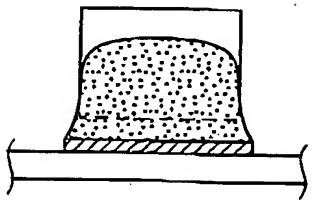


FIG.30(b)

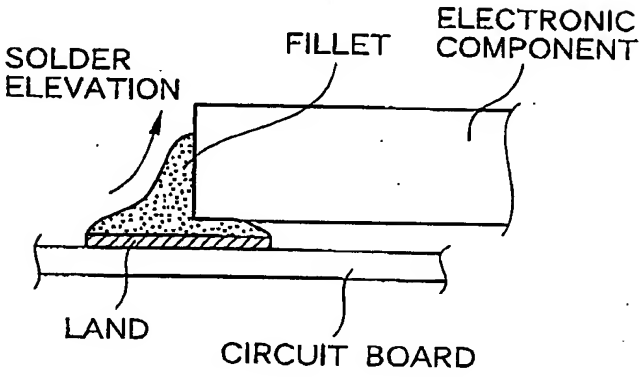


FIG.31(a)

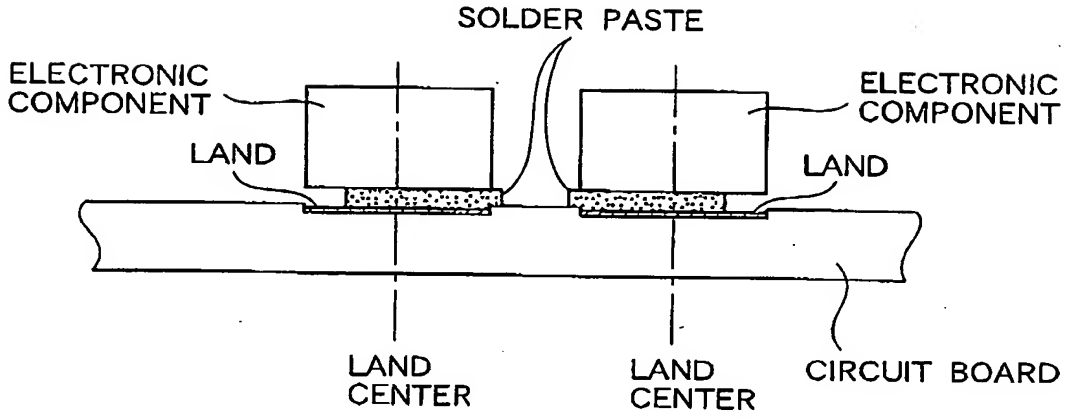
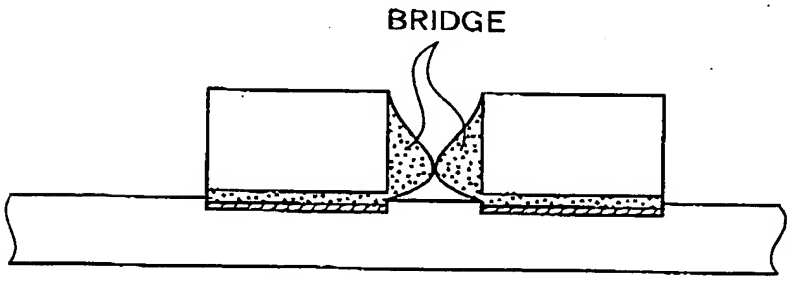



FIG.31(b)